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Typhlotechnics for Persons with Visual Impairment and Quality of Life

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Abstract

This paper deals with the modern trends in typhlotechnics in terms of quality of life for persons with visual impairment. A person with visual impairment is strongly influenced by the development of modern technologies. From the perspective of special education the support of people with visual impairment should take place not only by using the typhlotechnics, artificially made aids, but activity of the individual is equally important. The main method for the outputs of our paper selected was the analysis of foreign and local literature, mostly from the years 2008-2014. Comparison of specialized material allows the evaluation of the current state of development in the area and creation of an informational base for further research projects.

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Keywords: visual impairment, brain, sensory substitution device.

1. Introduction

A person with visual impairment is understood as a holistic unity, whose levels can be viewed from various perspectives. Accordingly, theoretical and practical approaches to a person with visual impairment vary and, for a professional, present a challenge to address a dilemma between progress, ethics and a humanistic approach. This paper presents the current trends in the development of typhlotechnics and the issues of quality of life of an individual with visual impairment.

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2. Person with visual impairment and quality of life

A person with visual impairment is a bio-psycho-socio-spiritual being. A person with impairment deserves attention as any other object or subject of the real world of science and life as such. Visual impairment thus has a biological, psychological, social as well as spiritual dimension. Ludíková (In Finková et al., 2012) states that a person with visual impairment is any individual suffering a visual defect or disease, where even after optimum correction, visual perception is impaired in an extent that causes problem in everyday life. According to Vágnerová (2011), a person with visual impairment is an individual that is unable to perceive all visual information easily and precisely. If we focus on visual impairment as decreased visual perception of information, we will have to consider the area of information deficiency, which is closely related to higher and lower compensatory functions. Regec, Stejskalová, et al. (2012) add that in case of information deficiency a substitute informer is required. It should be noted that the process of handling information also includes, apart from touch, hearing, smell and taste (lower compensatory functions), the nervous system as a higher compensatory function. Nakonečný (1998) sees the role of the nervous system in controlling the organism as a whole. Despite the fact that the activity of the nervous system can be distinguished into categories of a biochemical, biophysical, physiological (physical), psychological (mental) nature, the nervous system is still, including the brain, full of mysteries for neurologists. Bioelectric and biochemical principles of the nervous activity are indirectly indicated by the relationships between stimuli and reactions (inputs and outputs) in the micro-world, which is an analogy of the micro-world of quantum physics. Currently, the borders between social and natural sciences begin to fade away (Majerová, 2013). It can be concluded that in the area of special education of persons with visual impairment there have recently been two distinctive tendencies – human-oriented approach and approach oriented at the development of technology that facilitates an individual's life. The issue of increasing quality of life should, from the perspective of special education as a humanity-oriented discipline, respond both to the requirement for development and human approach. Progress should not lead to pure human passivity and dependence on an auxiliary piece of equipment but should encourage an individual to be an active element in the process of creating one's own life. This paper comments on the current trend in the area of auxiliary equipment designed for persons with severe visual impairment.

3. Current trends in the area of typhlotechnics and their assessment

Current trends to help persons with severe visual impairment include both invasive and non-invasive methods. A large group of non-invasive methods consists of sensory substitution devices (SSD). These devices use signals from other compensatory functions and substitute insufficient visual perception in blind individuals or persons with severe visual impairment (Shachar, Sami, Amir, n.d.) One example of these compensatory functions could be using acoustic stimuli to develop a spatial image. Here we would like to mention another compensatory device called 'vOICe' developed by Israeli scientists. A small camera integrated in the middle of spectacles is connected to a computer which transforms the camera image into acoustic stimuli and sends them on to earphones. These acoustic stimuli (sounds) differ in loudness and frequency and help individuals with visual impairment develop a soundscape of the environment. This device was tested on people who are fully blind according to WHO standards. The experiments indicate that after 70 hours of training people with visual impairment are able to use the device to identify various objects, such as houses, shapes, everyday objects and their surface. Some were even able to identify the location of other people, expressions in their faces or even letters and words (Striem-Amit, Amedi, Cohen & Dehaene, 2012; Healy, 2012; Hebrew University of Jerusalem, 2012). One of the advantages of this device is its discreet nature; spectacles and headphones are worn by almost everybody, a small computer can fit into a backpack or handbag. Another advantage is simple application, no surgery or strenuous training is required. The principle of the device is based on natural compensatory abilities of an individual with visual impairment.

The field of optobionics and invasive methods of compensating severe visual impairment offers retinal implants developed in various research laboratories around the world. These implants are designed especially for patients with diagnosed retinis pigmentosa or macular degeneration. Some modern implants have been approved for use and are provided with European CE marking. According to their own comparison of clinically available data on the degree

of restoration of visual perception and long-term compatibility with the human body, Chuang, Margo and Greenberg (2014) highlighted the Alpha-IMS product, which is unique in that it consists of 1,500 microphotodiodes and is of a subretinal design. Other implants are based on an external camera and electrode system. Despite the fact that most implants were tested on humans who could then identify various objects and even letters (which is of special importance for young people during their study), collateral complications are still quite serious (e.g. retinal detachment, bleeding, infection, etc.)

Another invasive method uses brain implants; this method was pioneered and promoted by William Dobelle. The founder of a research institute in Portugal bearing his name managed to implant chips into the brain of several blind people. These chips were connected to an external camera installed on spectacles and provided visual perceptions. Over 10 people had the chips implanted, however, complications were so serious that the institute was closed after William Dobelle's death in 2004 (Dobelle, 1992; Port, 2000; Tuller, 2004). This technology is still being developed by numerous institutes, one example is research carried out by scientists of the Monash Vision Group at Monash University in Australia. The principle of their bionic eye is wireless transfer of visual perceptions into a brain implant that restores the vision process in individuals with visual impairment (Roginski, 2013).

Considering the trends described above it might be concluded that facilitating vision in persons with visual impairment should move ahead according to the latest scientific findings. On the other hand, ethical principles should be respected so that special education of persons with visual impairment retains the hallmarks of an educational discipline. As professionals we can offer an auxiliary device, however we should exert the same effort to stimulate higher and lower compensatory functions through natural non-technical ways – training of touch, hearing, smell, taste, without using additional devices, just through everyday activities; and through stimulation of the central nervous system by means of mental hygiene exercises, memory training, imagination, attention, active learning ensuing from the 'human body', unsupported by an artificial system. Searching for a suitable compromise between these possibilities might prevent unilateral development in the future. At the end we would like to emphasise the importance of quality of life in individuals with visual impairment as quality and full life should be our real target. This issue is currently addressed by a research study carried out at Palacky University in Olomouc – Research of quality of life of selected groups of persons with special needs (IGA_PdF_2014008).

4. Conclusion

Visual impairment is a reality that cannot be denied; acceptance and efficient work with the initial condition of an individual in line with the individual's needs is of crucial importance. The development of lower and higher compensatory functions is a natural part in the process of a supportive approach to a person with severe visual impairment. Such support can take the form of typhlotechnics, i.e. artificially developed aids; on the other hand, own activity of an impaired person and everyday training of compensatory functions and stimulation of the central nervous system are of identical significance. Typhlotechnic and human support in general should enhance the quality of life of individuals.

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